

This is unintelligible in view of the fact that the difference between the initial and final pressures does not increase, while in case of supply from a cylinder of compressed gas, it actually decreases. On p. 232 we find the sentence: "Below the temperature of zero degrees ice slowly sublimates." Some misprints have escaped correction. On p. 208 the minus sign is omitted between k and l in equation (7). On p. 243 the second "i" in the name Lavoisier has been omitted.

If in a new edition such mistakes be corrected, and the latter part of Chapter iv., Section 3, be rewritten, the book will be useful as well as interesting to the class of readers for whom it is chiefly intended.

Prof. Lefèvre's book is very well written and clearly illustrated. Within the narrow limits of 175 pages it contains a considerable amount of correct theory, a very interesting history of the experimental development of gas-liquefaction, some discussion of industrial applications, and a very full list of references to original authorities; and all this with a surprising freedom from the evils of over-compression. The arrangement is not altogether perfect. Prof. Dewar's apparatus figured on pp. 55 and 61 apply the combination of free expansion with counter-current interchange, a method of which there was earlier authenticated invention both in England and Germany. These applications should have been described in Section 35 under the head "*Machines à détente sans travail extérieur*," and after the invention on which they depend; or, if it was thought advisable to discuss them out of chronological order, their dependence on the combination in that invention should have been clearly brought out. The illustration of Mr. Tripler's apparatus on p. 84 might well have been omitted. The employment of three-stage compressors, with cooling coils between the stages, with purifiers, water-separators, and pressure-gauge, was familiar to pneumatic engineers for years before they were employed by Mr. Tripler in liquefying air; and the vitally important interchanger and expansion valve remain such a mystery that the illustration gives no idea what they are like or whether they differ essentially from the invention of Dr. Linde and Dr. Hampson. On p. 70 the statement that helium was liquefied at the temperature of boiling hydrogen needs correcting in accordance with later results. Chapter ix., on modern commercial refrigerating machines, is very much out of proportion with the rest of the book; a discussion of this subject, which entirely passes by the great American and British developments in this field, might as well be omitted altogether.

A CONTRIBUTION TO ZOO-GEOGRAPHY.

Studien zur Geographie. Von Dr. W. Kobelt. Zweiter Band. Pp. x + 369. (Wiesbaden: Kreidel, 1898.)

IN this, the second part of his "studies," Dr. Kobelt deals at full length with the characteristics of the fauna and to some extent also, of the flora of the "Meridional Sub-region." This region very nearly corresponds to the Mediterranean sub-region of Dr. Wallace; its northern limits are a trifle more extensive, embracing as they do the Crimea and Bessarabia.

As might be expected from the nature of his own zoological studies, the author lays most stress upon the

distribution of Mollusca, and gives a series of elaborate and apparently very full tables of species found in the different departments into which he divides the region described in this volume. It must not, however, be inferred from this that other groups of animals are neglected or even treated with indifference.

A great deal is said about the range of the vertebrata of this part of the world in the past as well as in the present, all the orders of that assemblage of animals being taken into consideration. There is one group of terrestrial, aquatic and semi-aquatic invertebrates which are not at all discussed by Dr. Kobelt. This group—that of the earthworms and their allies—might profitably have been dealt with, inasmuch as their range, so far as is known, marks out very well not only the limits of the Palearctic region (excluding only Japan), but also enables a line to be drawn between the more northern and the Mediterranean portions of the region dealt with by Dr. Kobelt. Inasmuch as a large portion of the meridional region is occupied by the Mediterranean sea, the author is, we think, wise in paying some attention to the fauna of that sea, as well as of other stretches of water included within his area. A special chapter is devoted to the Mediterranean, and the author commences by addressing himself to the problem as to whether that inland sea is really an independent tract or a section of the Atlantic.

The colossal faunistic and structural monographs issued by the Naples Zoological Station, as well as the results of elaborate studies carried on at similar institutions along the coasts of the Mediterranean, have made us well acquainted with the shallow water fauna of that sea. We are less informed as to the pelagic creatures, especially mammals, and about the deep-sea fauna. As to the former, observes the author, "the mammalogist will, with a regretful shrug of the shoulders, confess himself incompetent" to speak with accuracy. So far as we know, the whales are not special to that sea; nor does palæontological evidence hint at the Mediterranean as a centre of origin. Oliver Goldsmith, in his "*Animated Nature*," pointed out that the Mediterranean dolphin occurred in the Red Sea. He was doubtless right, though the reasoning employed may have been defective, and there is no prevision of the Suez Canal! The sperm whale is found therein, and (if we may regard the sea beast from which Perseus delivered Andromeda as a "monstrous physetere"!) was even known to the ancients. Pliny's Orca was, it appears, rather that "sea should'ring whale" than a gladiator. The dolphin of the Mediterranean has received many names, but there seems to be little doubt that that whale of Greek coins is exactly the same as the dolphin of the coasts of the Atlantic. "As concerns mammals," concludes Dr. Kobelt, "the Mediterranean is an impoverished gulf of the Atlantic Ocean."

In the characteristics of the Mollusca found, and some other animals, the Mediterranean presents tropical characters which are, partly at least, in reality due to the Suez Canal. Mr. E. A. Smith, of the Natural History Museum, contributed some years since a number of interesting facts to the Zoological Society bearing upon such immigrations. The Mediterranean, as is well known, sinks in places to profoundly abyssal depths; the actually greatest depth appears to be 4400 metres; but

here no living organisms have been found. It is purely azoic; the reason for the want of life is, according to the author, the want of oxygen and the abundance of carbonic acid.

There is, in fact, no special deep-sea fauna found in this large tract of water.

Turning to the terrestrial mammalia, the author comes to the conclusion (elaborated in a special and highly interesting chapter) that their range to-day is in thorough agreement with the distribution of land and water. The Mediterranean southwards and the Bosphorus westwards form barriers which divide faunas. This is illustrative of what is apt to be a common error in text-books of zoology. When Mr. Sclater originally divided up the earth into zoological regions, he did not profess to do so for more than the Passerine birds, though his conclusions were shown later by himself and by others to apply to other groups also. They do not, however, in the least apply to various invertebrate groups; and in dogmatically dividing the world into the Sclaterian regions, the writers of some text-books have entirely lost the prime object of such a regional division. The more modern Eutherian mammals are controlled in their range by what are largely existing barriers; the more ancient molluscs show in their distribution the non-existence of such barriers in ancient times. Dr. Kobelt dwells upon the distinctness of northern Africa from Europe so far as concerns its mammalian inhabitants. He is disposed to dismiss the Gibraltar monkey as truly indigenous to that peninsula, though admitting the occurrence of fossil allies in European strata of Pleistocene and Pliocene age.

On the whole, however, we are not certain that Dr. Kobelt has taken so fortunate an instance as he might have done to illustrate the effects of modern barriers in the dispersal of mammals. It is perhaps a little too strong, in the face of the lists which he gives, to state of the Straits of Gibraltar and the narrow passage opposite to Carthage that they are "faunistic boundaries of the first rank." The division between the arctic and the non-arctic parts of the palæarctic region are more easily defined from their mammalian indigenes.

Dr. Kobelt's book is closely packed with solid fact, and there is no more speculation than is necessary to give prominence to such generalisations as appear to him to be the legitimate outcome of his laboriously collected material. This has been amassed from the most diverse sources; and the author by no means disdains the older writers, even the ancients being laid under contribution. We commend the book to the serious student of zoogeography only, for it is emphatically not to be trifled with in an arm-chair.

F. E. B.

A TEXT-BOOK OF HEAT MOTORS.

The Steam Engine and Gas and Oil Engines. By John Perry, D.Sc., F.R.S. Pp. viii + 646. (London: Macmillan and Co., Ltd., 1899.)

THIS is one of the best books which has been published in this country on the steam engine and other heat motors. The method and style is thoroughly characteristic of Prof. Perry. Many will no doubt object to the order of arrangement of the various chapters, and

NO. 1570, VOL. 61]

will be inclined to think the author has put the cart before the horse; the author will probably reply that the book was not written for the beginner, but for advanced students.

There is something to be said for the plan adopted; if a text-book for students, engaged during the day in practical engine work, is given up in its early chapters almost entirely to the properties of steam and thermodynamic problems, there is great risk that the student will be discouraged and eventually give up the attempt to improve his knowledge of the principles underlying the working of heat motors.

The author's plan is to deal first with the more practical details, in the hope probably that in mastering these the student will find out what he lacks and what he needs of thermodynamics and kindred subjects. Granted this, it is still a little difficult to see that an improvement would not be effected by putting Chapters xv., xviii. and xix. on methods of calculation, on temperature and heat, and on the properties of steam, earlier in the book. This is shown by the necessity of a footnote on p. 99 to explain the way in which the total heat required in evaporating a pound of steam is determined.

Chapter ii. is devoted to description of cylinders, pistons, valves, frames, &c., of what the author calls the commonest form of steam engine, but as the details explained include parts of steam turbines, the title is hardly happy. The illustrations in this chapter are extremely good and complete.

Chapter iii. deals with the value of expansion, and the author points out, as a result of his calculations, that there are limits of economic expansion, and how easily the Willan's law can be deduced from such calculations.

Chapter iv. describes the indicator, its construction and the proper way to use it, and the errors it is liable to. Then, in the following chapter, come a most valuable series of exercises on calculations from indicator cards.

One of the chief merits of the book, apart from the fact that it is so thoroughly up to date in all its information and methods, is the way in which almost every chapter is filled with numerical exercises; any student genuinely working these out for himself cannot fail to become thoroughly master of the main problems confronting the student of heat motors.

In this chapter again (v.) we have a little awkwardness introduced from the particular arrangement adopted by the author. One of the exercises is the drawing of a $\theta\phi$ diagram, and no explanation of this has been given, the reader is referred for explanations to a much later chapter of the book. We fear the student is not likely to start with much knowledge of entropy, and will therefore probably skip these sections.

The next eight chapters are devoted to the mechanical details of valves, governors, air pumps, boilers and their fittings and accessories.

The first fourteen chapters may be said to mainly deal with the mechanical details of engines and boilers; while the rest of the book is devoted to what may be called theory and principle.

In Chapter xvi. the author deals with the cost of production of energy and the efficiency of various types of motors, a most complete and valuable chapter full of good examples. Then come some chapters on tem-